Oysters as Indicators of Bioavailable Butyltins in Galveston Bay, Texas

Terry L. Wade
Geochemical and Environmental Research Group, College of Geosciences
Texas A&M University, 833 Graham Road
College Station, TX 77845
409-862-2323 EXT 134 - 409-863-2361 FAX
terry@gerg.tamu.edu

EDUCATION:

Ph.D. University of Rhode Island, Kingston, Rhode Island, 1978 (Chemical Oceanography)
M.S. University of Rhode Island, Kingston, Rhode Island, 1974 (Chemical Oceanography)
B.A. Hartwick College, Oneonta, New York, 1971 (Chemistry)

EXPERIENCE:

1998-Present	Deputy Director of Environmental Sciences, Geochemical and Environmental Research Group, College of Geosciences, Texas A&M University
1993-1998	Associate Director of Environmental Chemistry, Geochemical and Environmental Research Group, College of Geosciences, Texas A&M University
1992-Present	Research Scientist, Geochemical and Environmental Research Group, College of Geosciences, Texas A&M University
1986-1992	Associate Research Scientist, Geochemical and Environmental Research Group, Texas A&M University
1986-Present	Member, Graduate Faculty, Texas A&M University
1984-1986	Assistant Research Scientist, Dept. of Oceanography, Texas A&M University
1984-1986	Adjunct Assistant Professor, Dept. of Oceanography, Old Dominion University, Norfolk, VA
1982	NASA-ASEE Summer Faculty Fellowship Program, NASA Langley Research, Hampton, VA
1979-1984	Joint Appointment, Dept. of Chemical Science, Old Dominion University, Norfolk, VA
1978-1984	Assistant Professor of Oceanography, Dept. of Oceanography, Old Dominion University, Norfolk, VA
1971-1978	Research Assistant and Graduate Student, Graduate School of Oceanography, University of Rhode Island, Kingston, RI
1970	National Science Foundation Summer Research Assistant, Hamilton College, Clinton, NY

OYSTERS AS INDICATORS OF BIOAVALABLE BUTYLTINS IN GALVESTON BAY, TX

Terry L. Wade, Yaorong Qian, Jose L. Sericano, David Wylie
Geochemical and Environmental Research Group (GERG)
Texas A&M University, 833 Graham Road
College Station, TX. 77845

Tributyltin (TBT), an active ingredient in antifouling paint, and its degradation products continue to be detected in the environment ten years after the use of TBT was regulated. TBT was an excellent choice to solve the costly problem of fouling of the hulls of boats and ships. Although an effective antifouling agent, tributyltin adversely affects non-target organisms. TBT and its degradation products, dibutyltin (DBT) and monobutyltin (MBT), were detected in oysters from Galveston Bay collected as part of NOAA's National Status and Trends (NS&T) Mussel Watch Program. It is interesting to note that sediments from Galveston Bay show a higher incidence of detection of butyltins when compared to the entire the Louisiana Province based on EPA EMAP data.

The results from 1986 to 1997 of oyster analyses from Galveston Bay NS&T sites are presented. The Galveston Bay sites (6) where oyster butyltin concentrations were determined include: Hanna Reef (GBHR), Ship Channel (GBSC), Yacht Club (GBYC), Todd's Dump (GBTD), Offatts Bayou (GBOB), and Confederate Reef (GBCR). The locations of these sites are shown in Figure 1. The American oyster (*Crassostrea virginica*) samples were collected as part of the NS&T project in the winter (November to January) in order to collect the oysters before they spawn. All sample analyses were performed using standard methods that provide precise, reproducible and valid data. Details of the method used have been reported (Wade *et al.* 1991). The results from Galveston Bay are compared to oysters and mussels from other U.S. coastal sites as part of the NS&T project. The concentrations are all reported as ng Sn/g dry weight of tissue.

Total butyltins (sum of TBT, DBT and MBT) concentrations for the 54 oyster samples analyzed ranged from below the detection limit of 5 to 861 ng Sn/g (Table 1). The median concentrations were lowest at GBHR (60 ng Sn/g) and GBOB (63 ng Sn/g), higher at GBCR (246 ng Sn/g) and GBTD (255 ng Sn/g), and highest at GBYC (574 ng Sn/g) and GBSC (646 ng Sn/g). TBT, the most toxic butyltin, is also the major butyltin detected (~75%). A concentration of concern for oyster health is estimated at 500 ng Sn/g (Jackson *et al.* 1998). Oysters collected from GBSC and GBYC exceeded this limit in 10 of 15 (67%) of the samples analyzed. None of the oysters analyzed from the other Galveston Bay sites exceeded this 500 ng Sn/g limit. It should be noted that the information on the toxicity of butyltins is limited and TBT is a suspected endocrine disrupter. More research is necessary to prove that even low concentrations of butyltins are not effecting the environmental health of oysters and other organisms.

The overall trend in butyltin concentrations for the entire Gulf of Mexico (Jackson *et al.* 1998) has decreased from a median of 105 ng Sn/g (1986-1989) to 39 ng Sn/g (1990-1994). This decrease is likely due to the environmental response to the regulation of the use of TBT in antifouling paints in 1989. The dramatic decline in butyltin concentrations observed for most NS&T sites (Jackson *et al.* 1998) is not observed for all the Galveston Bay NS&T sites (Figure 2). In order to detect a trend (decrease or increase) in environmental monitoring data many years of data may be required. This is due to the difficulty separating the variability caused by natural processes compared to changes due to reductions in inputs. For example, the butyltin concentrations in oysters from GBOB and GBCR were lower in oysters collected after the 1989 limitations on butyltin usage compared to oysters collected in 1989 (Table 1 and Figure 2). However, the decrease is not monotonic. Oysters from GBYC, in contrast, do not show a significant decrease from 1989 to 1997. The concentration of butyltins at GBYC was 627 ng Sn/g in 1989 and 549 ng Sn/g nine years later. The butyltin concentration at GBYC in 1997 is above the concentration expected to be deleterious to these organisms. The reason for the slower decline in butyltins at some Galveston Bay sites is not apparent, but this trend was also found in other studies of Galveston Bay.

The likely sources for the butyltins that the oysters are continuing to bioaccumulate include sediments, boats larger than 25 meters, smaller boats that were painted before these paints were banned (TBT paints have a useful lifetime of 5 or more years), and/or wastes from shipyards. Bivalves are excellent sentinels of TBT contamination and allow for the determination of temporal and spatial variations of butyltin concentrations. Continued monitoring of bivalves to assess trends in the concentrations of bioavalable butyltin concentrations in Galveston Bay is prudent. Additional regulations of TBT may be required if current oyster concentrations at GBYC and GBSC do not decline.

Jackson, T.J., T.L. Wade, J.L. Sericano, J.M. Brooks, J.M. Wong, B. Garcia-Romero and T.J. McDonald 1998 Galveston Bay: Temporal Changes in the Concentrations of Trace Organic Contaminants in National Status and Trends Oysters (1986-1994). *Estuaries.* 27:718-730.

Wade, T.L, Garcia-Romero and J.M. Brooks. 1991 Oysters as Biomonitors of Butyltins in the Gulf of Mexico. *Marine Environmental Research.* 32:233-241.

Table 1. Galveston Bay Total Butyltin Concentration (ng Sn/g).

Year	GBSC	GBYC	GBTD	GBHR	GBOB	GBCR
1986	NS	452	255	52	NS	350
1987	NS	740	420	120	NS	420
1988	NS	724	282	199	NS	277
1989	752	488	175	62	249	265
1990	646	627	267	26	67	205
1991	NS	599	309	58	149	236
1992	524	469	220	71	45	220
1993	720	861	366	69	70	256
1994	317	NS	247	NS	59	NS
1995	NS	46	22	5	5	7
1996	NS	NS	NS	NS	NS	NS
1997	NS	549	80	29	32	57
MEDIAN	646	574	255	60	63	246
MIN.	317	46	22	5	5	7
MAX.	752	861	420	199	249	420

NS = NOT SAMPLED